FOREST PRODUCTS

Project Fact Sheet

Growth and Property Development of Convection-Pass Deposits in Recovery Boilers

Benefits

- Optimal boiler design and operating conditions
- Improvements in the boiler's thermal efficiency and capital effectiveness
- Better methods for cleaning convective surfaces
- Increased boiler availability and throughput
- Enhanced industrial productivity and competitiveness

Applications

More knowledge of the primary difficulties facing recovery operations and methods for controlling deposit formations will provide increased production capabilities to the pulp and paper industry. As members of the consortium reviewing this project, various companies will have timely access to the results of this project.

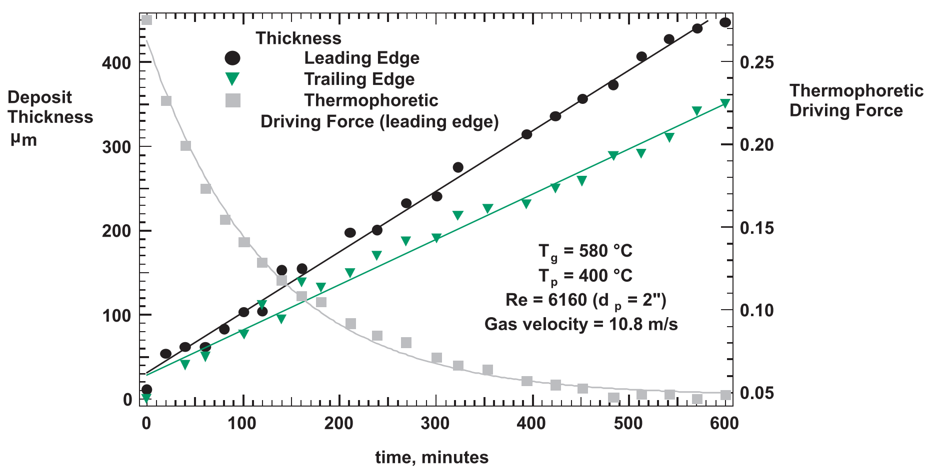
An improved understanding of recovery boiler deposits will help predict and control fouling

Recovery boilers in pulp and paper mills perform two key functions. First, they are used to recover inorganic chemicals from pulp processing so they may be recycled within the mill. They also transform the chemical energy in black liquor to thermal energy for use in generating steam and/or electricity. Both of these processes — chemical recovery and energy generation — are crucial to making pulping operations economical.

During normal operation of a recovery boiler, inorganic materials are deposited on the surface of the boilers which affect their subsequent performance. In particular, deposit formations in the convection pass section can strongly inhibit heat transfer and represents a major boiler operation and design limitation.

New techniques are available to quantitatively measure the deposition rate and the properties of these deposits. Such data would provide a better understanding of deposit formation in boilers. The commercial relevance of this information will be demonstrated by developing algorithms and incorporating these algorithms into 3-D predictive models. Comparing the experimental and model results with commercial-scale observations will validate their applicability and impact on boiler design and operation.

Deposition Rate vs Thermophoretic Driving Force



Comparison of measured fume deposition rate with thermophoretic driving force based on measured temperatures and particle size distributions. Thermophoresis, long thought to be the primary method of deposition, is not controlling or significantly affecting deposition rates for this submicron fume under conditions relevant to recovery boiler operation.

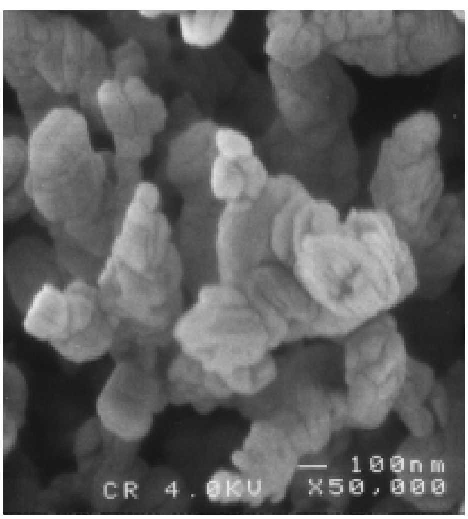
Project Description

Goal: Conduct a systematic investigation of the fundamental structural, optical, and transport properties of typical entrained particles and ash deposits in commercial-scale, black liquor recovery boilers.

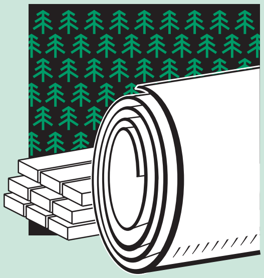
In Phase I, an experimental database will be established for organizing data on a variety of physical parameters for ash deposits on probes that simulate those found in commercial recovery boilers. Phase II is the development of suitable algorithms to show fundamental relationships between the measurements taken in Phase I and the composition and structure of the inorganic material. In Phase III, three-dimensional models will be used to verify the relevance of the algorithms to actual operating conditions.

Progress & Milestones

- A general description was produced of the formation and properties of ash deposits for convective passes.
- The radiative and thermal transport properties of both entrained particles and deposits were measured.
- The data are being incorporated into algorithms for use in computer codes.
- Completed in-situ, quantitative characterization of deposit grwoth rates for both fume and intermediate-size particles.
- Demonstrated that intermediate-size particles are required to generate the types of deposits industrial colleagues indicate are most common in convective passes.
- Demonstrated that thermophoresis is not a controlling mechanism for fume deposition.
- Developed theoretical basis for bounding and predicting deposit thermal conductivity and strength as a function of porosity and structure.



Scanning electron microscope image of fume deposit structure indicates that the deposits consist of long strands of particles with each strand being approximately one particle wide but with little contact from strand to strand.



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